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Linking science and industry

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History teaches us that many areas of the world invented and perfected a host of original techniques long before the European industrial revolution spread around the planet. Artifacts and documents prove, for example, that craftsmen in East Africa, India, China, and the Near East discovered independently of each other, and in many cases before the Europeans, how to transform iron ore into steel.

But historical hindsight of these accomplishments is small consolation for the regions that have, in the meantime, become "developing countries" that now import their scientific and technical knowledge from a few major centres.

The technological process that was once tightly woven into the fabric of their civilizations has been snapped short. Science and technology are now acquired from abroad, as 90 percent — or as much as 98 percent, according to some — of scientific research is carried out in the industrialized countries. Having already experienced a political and economic domination built on force, many countries are concerned that a monopoly in science and technology will continue the hegemony of these power centres. A number of researchers in the Third World are wondering, therefore, how to restore the native scientific and technical vigour of their countries.

The Latin American countries were among the first to organize themselves in order to acquire the tools that would permit them to appropriate modern science and technology. It was therefore fitting that one of the most ambitious studies ever undertaken of the scientific and technical policies of developing countries should begin on that continent. The Science and Technology Policy Instruments (STPI) study, coordinated by a Peruvian, Francisco Sagasti, has mobilized researchers from ten countries, not only Mexico, Peru, Venezuela, Argentina, Brazil, and Colombia in Latin America, but also India, Korea, Egypt, and Yugoslavia.

"Governments have tools for influencing the economic sector", says Francisco Sagasti. "Our objective was to identify similar instruments in order to translate general scientific and technical policies into concrete terms." Sagasti, who has been coordinator of the STPI project for several years, explains that the need for such a study was prompted by the meagreness of results achieved in a number of countries in spite of their adoption of scientific and technical policies, and the great sacrifices they made in order to train scientific personnel. "National researchers complained they were not being consulted, because most of the technologies used in their countries were imported." This involuntary unemployment of researchers pointed up the missing linkages between the developing countries' research and development resources and their industries.

The final report of the STPI project tells how indigenous researchers, disappointed that no one was calling on them, turned their energies towards the creation of a university research apparatus in which they were free to work on whatever they chose. Thus, the research budgets of the developing countries were in large part devoted to pure research. The report cites the example of the directors of the Venezuelan Association for the Advancement of Science, who only very recently accepted that national socio-economic priorities should guide their efforts.

National leaders were well aware of the problems caused by the absence of adequate links between the local scientific apparatus (supply) and industry (demand). Various measures were advocated and a certain number of additional instruments were introduced. But it was still difficult to measure the real impact of the policies adopted. That is why it became necessary to gather multidisciplinary teams within the framework of the STPI project in order to identify, classify, and describe in detail all of the science and technology policy instruments available to governments.

The project undertook a very great number of studies, which have now been completed. The final report indicates, among other things, that in most countries indirect instruments have overtaken direct instruments. Moreover, the indirect instruments, such as industrial financing, use of government purchasing power, and the setting up of tariff barriers, were applied to all industrial activity, without taking into account the fact that some industries are doubtless more important than others to the development of a country. For example, indiscriminate, blanket application of tariff policies to a host of imported products has been common. For their part, the direct instruments, including research laboratories and training programs for scientific personnel, have had a much lower impact than has been expected of them.

The final report also tells how one of the most popular industrial development policies, import-substitution industrialization, could bring about foreign domination of technical development. When the desire was to locally produce exact copies of imported products, the machines that manufactured these products inevitably had to be imported. After pointing out the danger presented by import-substitution industrialization to scientific and technical development, the study stresses the importance of stimulating demand for the services of national experts and research centres by designating certain sectors of the economy to make use of and develop traditional techniques, and by pursuing a vigorous government "buy domestic" policy. Use of local consultant firms, redefinition of standards and norms in the context of local conditions, programs of loans for innovation, and control of foreign investments constitute a number of other powerful instruments available to the country that wishes to match its scientific resources to its needs.

Nevertheless, the report makes no illusions about the development of the scientific and technical potential of the developing countries. It acknowledges that a few countries are breaking free: in India, Brazil, and Korea, a restoration of local technological vigour is well under way. On the other hand, the report recommends that most countries assign a priority to acquiring the resources that will allow them to import foreign technology to their advantage. The study states that governments have more room to manoeuvre in this area than they generally believe. Scientific and technical expertise that is capable of determining whether or not the importing of a given technology is in line with national objectives should be the favoured instrument, according to the report.

Lastly, although the final report offers no easy solutions, it at least draws up a complete list of the factors involved in science and technology policy. It also provides access to some 200 studies on the industrial sectors and policy instruments of the countries that were included in this vast study over its term of four years. □